REMARKS

Claims 1-28 are pending in the application. Claims 1-10, 14-24, 26 and 28 stand rejected. Claims 11-13 and 25-27 stand objected to.

Applicant respectfully requests reconsideration in view of the foregoing amendments and the remarks hereinbelow.

A. Rejections under 35 U.S.C. 103 Over Darrell et al., Kado et al. and Gupta.

Claims 1, 3-4, 6, 8, 15, 17-18, 20 and 22 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Darrell et al. (6,445,810), Kado et al. (5,905,807) in further view of Gupta (6,204,858).

In this regard, the Office Action contends that Darrell et al. describes generally a method for determining whether "a pixel is an object" based upon the intensity of a pixel. It is the applicant's understanding that Darrell et al. describes a facial detection system that uses three modules to track a user's head: depth estimation, color segmentation i.e. skin color detection, and facial pattern classification. Iris detection is not described in Darrell et al. The Office Action admits that Darrell et al. "is silent disclosing object recognized is an iris" and further admits that Darrell et al. is "silent teaching red intensity of pixels."

Accordingly, the Office Action combines Darrell et al. with Kado et al. and Gupta in an attempt to meet the limitations of claim 1. Specifically, Kado et al. is said to teach "iris detection (note Fig. 8, 105 and Fig. 9, 302)..." and to "recognize an iris has a part of facial recognition. Kado' system provides a more accurate means for extracting facial features (note: 1 lines 58-59 and col. 2 lines 1-4.)" Gupta is said to disclose measuring the red intensity of pixels.

By way of introduction, it will be shown herein that Kado et al. teaches away from the present invention and from Gupta in that Kado et al. requires reducing an image to a binary – black or white - image which is then searched for round objects that could be irises while Gupta requires color analysis of an image to find irises. The method of Gupta therefore cannot be used in conjunction with any method that reduces the image to a binary – image. Further, it will be shown herein that both Kado et al. and Gupta teach away from the present invention as claimed in that Kado requires a search for round shaped black and white areas and Gupta requires a search for shaped colored areas.

Further, it will be shown that the references alone and in combination fail to teach or suggest the claim 1 method steps: of determining the probability that each pixel is an iris based upon the red intensity of the pixel, determining the probability that each pixel is not an iris based upon the red intensity of the pixel; and/or determining whether each pixel is an iris by analyzing the relationship between the probability that the pixel is an iris and probability that the pixel is not an iris.

Finally, it will be shown that the portions of Gupta cited in the Office Action do not support the rejection.

1. Kado Teaches Away From Claim 1

The means used in Kado et al. to detect irises is contrary to claim 1 in that Kado et al. is explicitly limited to detecting irises by reducing an image to a binary edge map and looking for circular shapes in the binary edege map. Spcecifically, Kado et al. teaches that facial images captured by a television camera are

> *"provided to an edge extraction part 2, wherein edge processing is applied to the input image picture. The output, on which edge processing has been applied in the edge extraction part 2, is provided to a binary level conversion part 3. A binary level conversion process is performed in the binary level conversion part 3 on the extracted edges of a searching region of the facial image."*

This binary level conversion process eliminates any color information from the facial image. Further, in accordance with Kado et al.:

> *FIG. 2 shows the relationship between a face and each searching region for each facial element, namely an iris searching region for two irises, a mouth searching region for a mouth, a nose searching region for a nose, an eyebrow searching region for each eyebrow and two cheek searching regions for left and right cheeks. Each searching region is designed considerably larger than the related facial element or facial elements as shown in FIG. 2.*

As can be seen in Fig. 2 of Kado et al. after the facial image has been reduced to a binary map, six different iris searching regions shown as regions 1 – 6 in Fig. 2 of Kado et al. are used to analyze the face for circular shaped objects. Shape matching correlation is used to determine which of these regions contains irises. Specifically, as is noted in Col. 4, lines 23 – 36 of Kado, where no round shapes are found in searching areas 1 and 2, they are given a low correlation value

for being an iris. However, where round shapes are found that have a high correlation value with regard to a distance therebetween and an inclination of the line connecting the irises as are found in areas 3 and 4, these shapes can be given a high correlation value.

Thus, the combination of Darrell et al. and Kado et al. would teach a combination that uses four different methods for locating a face in an image, three of which are described in Darrell et al.: color segmentation – to detect skin colors, facial pattern recognition – but not iris detection, and depth estimation. In addition, the combination would also use a fourth method for facial recognition: the iris detection method of Kado et al. which reduces an image to a binary edge map and detects circular objects in the edge map that correspond to irises as described in Kado et al.

None of this teaches or suggests the method steps of measuring the red intensity of the pixels in the image, determining the probability that each pixel is an iris based upon the red intensity of the pixel, determining the probability that each pixel is not an iris based upon the red intensity of the pixel; and determining whether each pixel is an iris by analyzing the relationship between the probability that the pixel is an iris and probability that the pixel is not an iris.

Importantly, Kado et al. explicitly teaches away from using any color data to detect irises in an image by directing one of ordinary skill in the art to detect irises using a binary edge map which has no color data.

2. Kado et al. teaches away from combination with Gupta.

The Office Action states that "Darrell and Kado is silent teaching red intensity of pixels." This, however, is not true, Kado is not silent on this point – it clearly teaches that a color image is to be reduced to a binary edge map which in turn is to be analyzed. Such a binary edge map CANNOT contain original color data. Therefore Kado et al. teaches against using the red intensity of the pixels for any purpose. Such information is discarded the moment that the image is converted into a binary image.

The Office Action attempts to use Gupta to supply a color analysis component noting that "Gupta measure red intensity of pixel (note col. 5 lines 15 –25)" However, it is not possible to combine Gupta which describes "identifying pixels of a digital image having color data corresponding to a predetermined color

and shape characteristics…" with Kado et al. on this point as Kado et al. specifically teaches against color analysis of an image.

<u>3. Kado and Gupta require shape detection.</u>

The methods disclosed in both Kado et al. and Gupta requires shape recongintion. That is, Kado et al. requires searching for round shapes in an image that has been reduced to a binary image. While in a basic embodiment of Gupta searching is required for round shaped red areas. In other embodiments, Gupta compares red intensity of round arrangements of pixels in an image to the intensity of other colors in areas adjacent to those pixels. As is noted in Gupta:

> *Automatic color adjustment in digital images is desirable in some situations. For example, automatic color adjustment may be desired to adjust recurring and identifiable photographic discolorations. An example of such a discoloration is the "red eye" effect that often occurs in photographs. FIG. 1 illustrates the natural coloring of an eye 100 , having a colored iris 110 and a blackish pupil 120 . FIG. 2 illustrates an eye 200 with the red eye effect, in which a red circular shape 220 at least partially (and sometimes completely) obscures the iris 210 and typically obscures the entire pupil 120 (FIG. 1). A small white circular glare 230 often appears in the center of the red eye portion 220 .*
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> *Occurrences of the red eye effect share these common features and thus are identifiable by a red circular area 220 , frequently having a white center 230 and surrounded by a non-red background 210 . In some cases, the non-red background 210 may be a ring of the iris color as shown in FIG. 2 ; in other cases, if the red circular area 220 obscures the entire iris, the non-red background 210 may be the whites of the eye. The invention provides a method for automatically detecting and adjusting the color of such identifiable effects.*

Thus, Gupta requires analysis of not only the red intensity of the pixels in the image but also shape and other color intensities as necessary to detect the irises. Specifically, as is described in Col. 3, lines 12 – 65 of Gupta, red pixels are identified in the image and a set of filters is applied thereto. The filters, as illustrated in Fig. 6, seek out round red pixel sets, or round red pixel sets.

Accordingly, neither Kado nor Gupta incorporates a method step of determining the probability that *each pixel* is an iris based upon the red intensity of the pixel; determining the probability that *each pixel* is not an iris

based upon the red intensity of the pixel; or determining whether *each pixel* is an iris by analyzing the relationship between the probability that the pixel is an iris and probability that the pixel is not an iris. Instead both Kado and Gupta require analyzing an image to detect shapes.

Futher neither Kado nor Gupta describe any means for determining a probability that *each pixel* is an iris *based upon the red intensity of the pixel*, determining the probability that *each pixel* is *not an iris based upon the red intensity of the pixel.* As is admitted in the Office Action, Darrell et al. is silent on this point.

4. The portion of Gupta cited in the Office Action Does Not Support the Reference

The portion of Gupta cited in the Office Action does not, in fact, discuss iris detection. Instead this portion describes color correction techniques that detect original iris colors and use the original colors for image correction.

> *As shown in FIG. 2 , in some cases, the iris **210** surrounds the red eye circular area **220** . Thus, original color data of the image (not the color enhanced data of the image) of pixels within an area immediately surrounding the red eye area identified in steps **420** and **430** of FIG. 4 may be evaluated to determine the average ratio of r:g and r:b for the iris color (step **441** of FIG. **9**). Original color data of each pixel in the red eye area is next identified, and if a pixel's color is identified as red (having a strong red component r), new values r', g', and b' are calculated (step **442**) to approximate the ratios calculated for the iris color (step **441**).*

Accordingly Claim 1 and all claims that depend from claim 1 are believed to be in a condition for allowance. As the Office Action contends that independent claims 10 and 15 are rejected for simiar reasons, it is the position of the applicants that claims 10 and 15 and each claim that depends from these claims are in a position for allowance.

B. Rejections under 35 U.S.C. 103 Over Swain and Cham et al.

Claims 10 and 24 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Swain et al. in view of Cham et al. The following establishes

that there is no factual basis for the interpretation of Swain et al. offered in the Office Action.

In this regard, Swain et al is said to teach the method step of "finding a skin color region (note fig. 1 block 11 and col. 4 lines 12 – 15)(Blurring of the image finds skin region)" This statement is an incorrect interpretation of the Swain reference. Specifically, Swain discloses blurring the image because "

> *the nature of the eyes makes it easier to detect them in a blurred image than in the original focused image. So prior to determining the location of the eyes, the image is blurred." (Col. 3, lines 10 –15). ... Because the eyes are set in sockets, the eyes appear shadowed in images. The consequence of blurring the image is that this shading appears as dark regions surrounded by lighter skin. The dark regions als include eyebrows. The contrast bewetween the dark and light areas is used to locate and identify eye regions. (Col. 4, Lines 10-15)*

Thus, the interpretation of the Office Action is incorrect, as the blurring of the image does not constitute the step of finding a skin color region. Instead the step of blurring is just that – the step of bluring the image so that a contrast region comprising the eyes can be located. That the contrast is provided by a skin colored region is incidental to the detection of the contrast region.

Similarly, Swain fails to describe the step of detecting iris color pixels in a skin colored region. The Office Action contends that this is shown in Col. 4, lns. 45 – 60 of Swain which are said to indicate that "segmenting the eyes can detect iris color pixel in the facial skin region". However, these lines do not show this. These lines show segmenting the eyes based upon a whiteness threshold to separate the irises from the whites of the eyes.

Specifically, these lines state as follows:

> *Human irises are diffecnt colors; however, the remainder of the eyes is white. As white pixels have a value of 255, black pixels have a value of 0 and pixels in between hav a value in between, th threshold T is set high enough to separate the irises from the white pixels. This segments the irises from the white parts of the eyes and the corners. In one embodiment of the present invention, the threshold T used is 85 of 255.*

Accordingly, the actual color of the irises is unknown. What is known is that they are not white.

Swain further fails to show any embodiment of the invention wherein iris colored pixels are determined using a Bayes model – or any other color based probability model.

Accordingly, the Office Action cites Cham et al. because it discloses the use of a Bayes model. However there is nothing in Cham et al. that suggests the use of this bayes model for iris detection. Cham et al. merely shows the use of a Bayes model to determine a result. This is irrelevant. The Bayes model is a probability based mathematical theorem that has many applications. There is nothing in Cham et al. to suggest the use of this in combination with a patent such as Swain that does not even use the word probability.

Importantly neither Swain nor Cham et al. shows any of the limitations of: measuring the red intensity of the pixels in the skin color region; determining the probability that each pixel is an iris based upon the red intensity of the pixel; determining the probability that each pixel is not an iris based upon the red intensity of the pixel; and/or applying a Bayes model to the probability that the pixel is an iris, the probability that the pixel is not an iris, the probability of the occurrence of an iris in the skin colored region and probability of the occurrence of a non-iris pixel in the skin colored region.

It is respectfully submitted, therefore, that in view of the above amendments and remarks, that this application is now in condition for allowance, prompt notice of which is earnestly solicited.

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